BASIS FOR THE AMENDMENT

The specification has been amended to correct the inadvertent errors noted by the Examiner.

Claims 5 and 6 have been amended to obviate the Examiner's objection thereto under 37 C.F.R. § 1.75(c), Claims 10-13 thus having been added for the claims to encompass the scope of original Claims 5 and 6.

Added Claims 14 and 15 find basis at page 18, lines 7-10 of the specification.

Added Claim 16 defines the subordinate component as in Claim 13, not including Sn.

REMARKS/ARGUMENTS

Favorable reconsideration of this application is requested.

Claims 1-16 are in the case.

The discussion of this application with the Examiner on October 9, 2003, also resulting in the issue of a new Official Action is herewith acknowledged with appreciation.

Claims 1, 3 and 4 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Liu.

Claims 1-4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Humphrey in view of JP 235868 (JP '868).

Claims 5 and 6 stand rejected under 35 U.S.C. § 103(a) over Humphrey in view of JP '868 further in view of Yoshino.

Claims 1-4 also stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Liu in view of Humphrey and JP '868.

Claims 5 and 6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Liu in view of Humphrey and JP '868 further in view of Yoshino.

Claims 7 and 8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshino in view of Sonozaki and JP '868.

These rejections are traversed.

Specifically, with regard to the first embodiment of the invention, as so defined by Claims 1-6 and 10-13, the invention relates to an electrode composition containing a lithium fluoroborate-based salt in an electrolyte, wherein:

a poly(vinylidene fluoride) homopolymer is contained at least as a binder and a lactone is contained as an electrolyte solvent,

said poly(vinylidene fluoride) homopolymer being obtained by an emulsion polymerization process.

A feature neither disclosed nor made obvious by the references is the conjoint presence of both (1) a lactone as an electrolyte solvent and (2) the poly(vinylidene fluoride) homopolymer being one obtained by an emulsion polymerization process. On the other hand, when both of these limitations are satisfied, a lithium secondary battery is obtained evincing unobviously superior properties and characteristics with regard to reducing a decrease in capacity of a lithium secondary battery. This is so demonstrated by the comparative evidence in the case, as note Table 1 at page 23 of the specification reproduced below.

Table 1

Sample (%)	Rate of Capacity Decrease
Example 1	4.5
Example 2	6.7
Comp. Ex. 1	12
Comp. Ex. 2	14

As is evident from the results set forth in this table, when, as in Comparative Example 1, a lactone is present, but the poly(vinylidene fluoride) homopolymer is a suspension polymerization derived homopolymer, or, as in Comparative Example 2, the poly(vinylidene fluoride) homopolymer is an emulsion derived polymerizate, but no lactone is present, significantly and materially inferior results are obtained. Such a result is manifestly unobvious.

With regard to the rejection of the claims under 35 U.S.C. § 102(b) over Liu, the Examiner himself recognizes that product-by-process limitations in the claims can be basis for patentable distinction, the burden however shifting to Applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. Such difference clearly has been demonstrated by the above discussed comparative

evidence. It manifestly establishes unobvious properties and results when the poly(vinylidine fluoride) homopolymer is an emulsion polymerization derived homopolymer.

Accordingly, withdrawal of the rejection of the claims under 35 U.S.C. § 102 is requested.

As to the rejection predicated on Humphrey et al, the Examiner recognizes that this reference does not disclose the salt being a lithium fluoroborate salt in a lactone solvent, further also containing a cyclic carbonate in an amount as defined. He thus additionally relies on JP '868 for its teaching of the presence of γ-butyrolactone.

However, any presumption of obviousness possibly made out by the references stands rebutted by the comparative evidence in the case, as discussed above. The unobviousness improvements realized due to the use of both an emulsion polymerization derived poly(vinylidene fluoride) homopolymer and a lactone clearly refutes any possible *prima facie* case made out by the combination of these references.

Yoshino, additionally relied on for the rejection of Claims 5 and 6, manifestly does not cure basic deficiencies of Humphrey in view of JP '868, for reasons as discussed above. JP '868 is relied upon by the Examiner only for asserted obviousness of the additional limitations of Claims 5 and 6, essentially similar reasoning in traversal thereof being applicable as in the rejection of the claims over Liu in view of Humphrey and JP '868. Any possible *prima facie* case of obviousness engendered by the combination of these references, similarly, stands rebutted by the comparative evidence in the case, as discussed above. Yoshino, additionally relied upon in this rejection, even if combined with the other references, manifestly does not remedy the basic inadequacies of the other references relied upon.

Accordingly, the rejection of Claims 1-6, as well as newly presented Claims 10-13, under 35 U.S.C. § 102 and § 103 clearly has been rebutted. Withdrawal of these rejections thus is requested.

With regard to the second embodiment of the invention, as defined by Claims 7 and 8, as well as newly added Claims 14 -16, the following is submitted in traversal thereof.

This embodiment relates to a lithium secondary battery, wherein:

a cathode, an anode and an electrolyte are encased in a housing,

a lithium-containing composite oxide comprising lithium cobalt oxide and a subordinate component element M, where M is a transition or typical metal element exclusive of Li and Co, in an amount of 0.001 to 2 at% relative to cobalt in the lithium cobalt oxide is contained as a cathode active substance,

60 to 95% by volume of γ-butyrolactone is contained as an electrolyte solvent, and

said housing has a thickness of 0.3 mm or smaller.

The results of Table 2 at page 30 of the specification are relevant to this embodiment, this Table being reproduced below.

Table 2

Sample	Substituent Element/at(%)	Solvent /volume	1C Capacity (mAh)	Specific Capacity -20℃(%)	Swelling During Storage at 90℃ 0	after 30 min.	after 4 hr.
Example 1	Nb/0.1	EC:γBL/2:8	570	20	4.23	4.30	4.31
Example 2	Ti/0.1	EC:γBL/2:8	567	18	4.25	4.29	4.30
Example 3	Sn/0.1	EC:γBL/2:8	566	15	4.23	4.30	4.32
Example 4	Mg/0.1	EC:γBL/2:8	564	13	4.22	4.30	4.33
Example 5	Nb/0.001	EC:γBL/2:8	571	12	4.20	4.23	4.23
Example 6	Nb/0.01	EC:γBL/2:8	571	16	4.20	4.22	4.25
Example 7	Nb/1	EC:γBL/2:8	566	16	4.21	4.22	4.26
Example 8	Nb/2	EC:γBL/2:8	562	14	4.23	4.29	4.29
Example 9	Nb/0.1	EC:γBL/4:6	561	15	4.24	4.27	4.28
Example 10	Nb/0.1	EC:γBL/5:95	565	13	4.23	4.28	4.30
Comp. Ex. 1	Nb/0.0001*	EC:γBL/2:8	572	8+	4.21	4.25	4.26
Comp. Ex. 2	Nb/10*	EC:γBL/2:8	498×	18	4.23	4.31	4.34
Comp. Ex. 3	Nb/0.1	EC:γBL/5:5*	526×	17	4.25	4.29	4.30
Comp. Ex. 4	Nb/0.1	γBL/100*	512×	19	4.22	4.28	4.28
Comp. Ex. 5	Nb/0.1	EC:DEC/2:8*	572	13	4.23	4.32	4.55++
Comp. Ex. 6	Nb/0.1	EC:MEC/2:8*	574	27	4.22	4.40	5.16++
Comp. Ex. 7	Ti/0.1	EC:MEC/2:8*	572	25	4.20	4.38	4.94++
Comp. Ex. 8	Sn/0.1	EC:MEC/2:8*	571	20	4.24	4.37	4.88++
Comp. Ex. 9	Mg/0.1	EC:MEC/2:8*	571	21	4.23	4.39	4.98++
Comp. Ex.10	—*	EC:γBL/2:8	566	7+	4.23	4.27	4.28

*) deviations from the inventive range
+) deviations from the allowable range for -20℃ specific capacity
++) deviations from the allowable range for swelling during storage
×) deviations from the allowable range for 1C capacity

It is apparent from the results of Examples B-1 to B-4 and Comparative Examples B-5 to B-9 shown in Table 2, that even with the cathode active substance to which such additive elements are added which usually give rise to outgassing, it is possible to prevent any outgassing by the use of γ-butyrolactone. Batteries of even smaller size thus can be fabricated by use of a thin housing. The permissible range of thickness changes is within 0.2 mm.

From Examples B-1 to B-10 and Comparative Examples B-1 to B-10, it is evident that low-temperature properties can be improved by the additive elements, the acceptable specific capacity at - 20°C being at least 10%.

From Examples B-1, B-5, B-6 and B-7 and Comparative Examples B-1, B-2 and B-10, it is apparent that the addition of the additive element in an amount exceeding 2 at% causes capacity decreases and thus is unsuitable for high-capacity batteries. In the inventive examples, the allowable 1C capacity is at least 550 mAh. On the other hand, the addition of the additive element in an amount of below 0.001 at%, the specific capacity decreases at low temperature, thus being a problem at low-temperature operation.

From Examples B-1, B-9 and B-10 and Comparative Examples B-3 and B-4, it is seen that the proper amount of γ-butyrolactone to be added is in the range of 60 to 95% by volume.

From the above, it is apparent that the inventive secondary batteries have improved low-temperature properties with no risk of swelling at high temperature. These unobviously superior results manifestly are totally unobvious, they rebutting and possible presumption of obviousness conceivably made out by the combination of the three references relied upon by the Examiner, any presumption of obviousness possibly made out by their combination clearly standing rebutted by the comparative evidence in the case.

Accordingly, withdrawal of the rejection of Claims 7 and 8 under 35 U.S.C. 103, as well as allowability of Claims 14 -16, is requested.

It is submitted that this application is now in condition for allowance and which is solicited.

Respectfully submitted,

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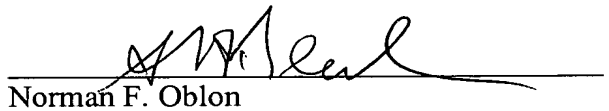

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